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# CSE 390a

# Lecture 5

Intro to shell scripting

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<http://www.cs.washington.edu/390a/>

# Lecture summary

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- basic script syntax and running scripts
- shell variables and types
- control statements: the for loop

# Shell scripts

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- **script:** A short program meant to perform a targeted task.
  - a series of commands combined into one executable file
- **shell script:** A script that is executed by a command-line shell.
  - bash (like most shells) has syntax for writing script programs
  - if your script becomes > ~100-150 lines, switch to a real language
- To write a bash script (in brief):
  - type one or more commands into a file; save it
  - type a special header in the file to identify it as a script (next slide)
  - enable execute permission on the file
  - run it!

# Basic script syntax

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## **#!** *interpreter*

- written as the first line of an executable script; causes a file to be treated as a script to be run by the given interpreter
  - (we will use `/bin/bash` as our interpreter)
- Example: A script that removes some files and then lists all files:

```
#!/bin/bash
```

```
rm output*.txt
```

```
ls -l
```

# Running a shell script

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- by making it executable (most common; recommended):  

```
chmod u+x myscript.sh
```

```
./myscript.sh
```
- by launching a new shell:  

```
bash myscript.sh
```
- by running it within the current shell:  

```
source myscript.sh
```

  - advantage: any variables defined by the script remain in this shell (seen later)

# echo

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command	description
echo	produces its parameter(s) as output (the <code>println</code> of shell scripting) -n flag to remove newline ( <code>print</code> vs <code>println</code> )

- Example: A script that prints your home directory.

```
#!/bin/bash
```

```
echo "This is my amazing script!"
```

```
echo "Your home dir is: `pwd`"
```

- *Exercise* : Write a script that when run on attu does the following:
  - clears the screen
  - displays the date/time: Today's date is Tue Apr 24 10:44:18 PDT 2012
  - shows me an ASCII cow or a message welcoming my user name

# Script example

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```
#!/bin/bash
```

```
clear
```

```
echo "Today's date is `date`"
```

```
echo
```

```
~rea/390/cowsay `whoami`
```

```
echo "These users are currently connected:"
```

```
w -h | sort
```

```
echo
```

```
echo "This is `uname -s` on a `uname -m` processor."
```

```
echo
```

```
echo "This is the uptime information:"
```

```
uptime
```

```
echo
```

```
echo "That's all folks!"
```

# Comments

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`# comment text`

- bash has only single-line comments; there is no `/* ... */` equivalent
- Example:

```
#!/bin/bash
```

```
# Leonard's first script ever
```

```
# by Leonard Linux
```

```
echo "This is my amazing script!"
```

```
echo "The time is: `date`"
```

```
# This is the part where I print my home directory
```

```
echo "Home dir is: `pwd`"
```



# Shell variables

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- ***name=value*** *(declaration)*
  - must be written **EXACTLY** as shown; no spaces allowed
  - often given all-uppercase names by convention
  - once set, the variable is in scope until unset (within the current shell)

```
NUMFRIENDS=2445  
NAME="Guess who"
```

- ***\$name*** *(usage)*

```
echo "$NAME has $NUMFRIENDS FB friends"  
Guess who has 2445 FB friends
```

# Common errors

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- if you misspell a variable's name, a new variable is created

```
NAME=Ruth
```

```
...
```

```
Name=Rob # oops; meant to change NAME
```

- if you use an undeclared variable, an empty value is used

```
echo "Welcome, $name" # Welcome,
```

- when storing a multi-word string, must use quotes

```
NAME=Ruth Anderson # $NAME is Ruth
```

```
NAME="Ruth Anderson" # $NAME is Ruth Anderson
```

# More Errors...

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- Using \$ during assignment or reassignment
  - `$mystring="Hi there" # error`
  - `mystring2="Hello"`
  - ...
  - `$mystring2="Goodbye" # error`
- Forgetting echo to display a variable
  - `$name`
  - `echo $name`

# Capture command output

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*variable*=`*command*`

- captures the output of *command* into the given variable

- Simple Example:

```
FILE=`ls *.txt`  
echo $FILE
```

- More Complex Example:

```
FILE=`ls -1 *.txt | sort | tail -1`  
echo "Your last text file is: $FILE"
```

- What if we leave off the last backtick?
- What if we use quotes instead?

# Types and integers

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- most variables are stored as strings
  - operations on variables are done as string operations, not numeric
- to instead perform integer operations:  
x=42  
y=15  
let z="\$x + \$y"           # 57
- integer operators: + - \* / %
  - bc command can do more complex expressions
- if a non-numeric variable is used in numeric context, you'll get 0

# Bash vs. Java

Java	Bash
<code>String s = "hello";</code>	<code>s=hello</code>
<code>System.out.println("s");</code>	<code>echo s</code>
<code>System.out.println(s);</code>	<code>echo \$s</code>
<code>s = s + "s"; // "hellos"</code>	<code>s=\${s}s</code>
<code>String s2 = "25";</code> <code>String s3 = "42";</code> <code>String s4 = s2 + s3; // "2542"</code> <code>int n = Integer.parseInt(s2)</code> <code>    + Integer.parseInt(s3); // 67</code>	<code>s2=25</code> <code>s3=42</code> <code>s4=\$s2\$s3</code> <code>let n="\$s2 + \$s3"</code>

x=3

- x vs. \$x vs. "\$x" vs. '\$x' vs. \'\$x\' vs. 'x'

# Special variables

variable	description
\$DISPLAY	where to display graphical X-windows output
\$HOSTNAME	name of computer you are using
\$HOME	your home directory
\$PATH	list of directories holding commands to execute
\$PS1	the shell's command prompt string
\$PWD	your current directory
\$SHELL	full path to your shell program
\$USER	your user name

- these are automatically defined for you in every bash session
- *Exercise* : Change your attu prompt to look like this:  
jimmy@mylaptop:\$
  - See `man bash` for more details on setting your prompt

# \$PATH

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- When you run a command, the shell looks for that program in all the directories defined in \$PATH
- Useful to add commonly used programs to the \$PATH
- Exercise: modify the \$PATH so that we can directly run our shell script from anywhere
  - echo \$PATH
  - PATH=\$PATH:/homes/iws/rea
- What happens if we clear the \$PATH variable?



# set, unset, and export

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shell command	description
set	sets the value of a variable (not usually needed; can just use x=3 syntax)
unset	deletes a variable and its value
export	sets a variable and makes it visible to any programs launched by this shell
readonly	sets a variable to be read-only (so that programs launched by this shell cannot change its value)

- typing set or export with no parameters lists all variables
- *Exercise:* set a local variable, and launch a new bash shell
  - Can the new shell see the variable?
  - Now go back and export. Result?

# Console I/O

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shell command	description
read	reads value from console and stores it into a variable
echo	prints output to console
printf	prints complex formatted output to console

- variables read from console are stored as strings
- Example:  

```
#!/bin/bash  
read -p "What is your name? " name  
read -p "How old are you? " age  
printf "%10s is %4s years old" $name $age
```

# Command-line arguments

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variable	description
<code>\$0</code>	name of this script
<code>\$1, \$2, \$3, ...</code>	command-line arguments
<code>\$#</code>	number of arguments
<code>\$@</code>	array of all arguments

- Example.sh:

```
#!/bin/bash
```

```
echo "Name of script is $0"
```

```
echo "Command line argument 1 is $1"
```

```
echo "there are $# command line arguments: $@"
```

- Example.sh argument1 argument2 argument3

# for loops

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```
for name in value1 value2 ... valueN; do  
    commands  
done
```

- Note the semi-colon after the values!
- the pattern after `in` can be:
  - a hard-coded set of values you write in the script
  - a set of file names produced as output from some command
  - command line arguments: `$@`
- *Exercise*: create a script that loops over every `.txt` file in the directory, renaming the file to `.txt2`

```
for file in *.txt; do  
    mv $file ${file}2  
done
```

# Exercise

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- Write a script `createhw.sh` that creates directories named `hw1`, `hw2`, ... up to a maximum passed as a command-line argument.

```
$ ./createhw.sh 8
```

- Copy `criteria.txt` into each assignment  $i$  as `criteria(2*i).txt`
- Copy `script.sh` into each, and run it.
  - output: `Script running on hw3 with criteria6.txt ...`

- The following command may be helpful:

command	description
<code>seq</code>	outputs a sequence of numbers

# Exercise solution

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```
#!/bin/bash
# Creates directories for a given number of assignments.

for num in `seq $1`; do
    let CNUM="2 * $num"
    mkdir "hw$num"
    cp script.sh "hw$num/"
    cp criteria.txt "hw$num/criteria$CNUM.txt"
    echo "Created hw$num."
    cd "hw$num/"
    bash ./script.sh
    cd ..
done
```